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INFORMATION REQUIREMENTS FOR

THE NEW CONTRACT PROGRAMMER

THESIS

Donald J. Kellogg
Captain, USAF

AFIT/GEM/DEM/86S-15

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AIR FORCE INSTITUTE OF TECHNOLOGY
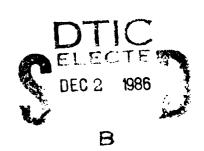
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INFORMATION REQUIREMENTS FOR

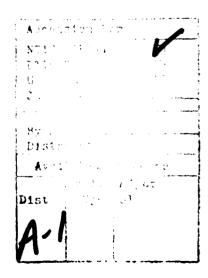THE NEW CONTRACT PROGRAMMER

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AFIT/GEM/DEM/86S-15

INFORMATION REQUIREMENTS FOR THE NEW CONTRACT PROGRAMMER

THESIS

Presented to the Faculty of School of Systems and Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the

Requirements for the Degree of

Master of Science in Engineering Management

Donald J. Kellogg, B.S.

Captain, USAF

September 1986

Acknowledgments

This thesis is dedicated to my loving and patient wife, Shelley, and my lovable and impatient newborn daughter, Pamela.

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Abstract

The objective of this research was to determine what information the current Air Force contract programmers in the field perceive should be included in a handbook designed to help new personnel learn the job of contract programming as quickly as possible. A census was conducted using the mail survey technique. Responses to the survey were tabulated and analyzed using various statistical techniques. This research resulted in the identification of 15 information topic areas which could be incorporated into a contract programmer's handbook. In addition, the research pointed out the need for such a handbook as indicated by the high return rate of the survey.

INFORMATION REQUIREMENTS FOR

THE NEW CONTRACT PROGRAMMER

I. Introduction

Overview

Base level civil engineering contract programming is
vital to the mission of Air Force bases located throughout
the world. Contract programming personnel program
maintenance, repair, and construction projects for the bases
so that present and future mission requirements can be met.

Contract programmers collect information and prepare
documentation to support such vital programs as the Military
Construction Program, the Operations and Maintenance
Program, the Nonappropriated Funds Program, and the Military
Family Housing Program for the various bases. These
programs, along with others, result in the maintenance,
repair, and construction of facilities and utilities located
throughout the Air Force.

The job of contract programming is very dynamic, and
requires the programmer to be flexible enough to adjust to
frequent changes in programming requirements and guidance.
These changes can be brought about by many factors,
including changes in Major Command (MAJCOM) and Headquarters
United States Air Force (HQ USAF) programming guidance.
Whatever the reason, contract programmers must know their

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job well enough to adjust, oftentimes quickly, to programming changes and maintain program continuity.

Personnel newly assigned to contract programming should learn the job of contract programming as quickly as possible. An effective, productive programmer is an individual who can produce quality project documentation while responding to program requirements that are continually changing. A programmer must be effective so that vital projects are not delayed due to the programmer's inability to adjust to changing requirements. A further discussion of the job of contract programming as well as the roles and responsibilities of the base level civil engineering squadron is presented in Chapter II.

Statement of the Problem

Often personnel newly assigned to programming are left to "learn by doing" the job of contract programming. They stumble through by the process of trial and error. They are told to read regulations pertaining to contract programming and ask questions of other contract programmers. This process of learning can be very slow and frustrating for the new contract programmer.

Even though trial and error and "learn by doing" are perhaps necessary to learn the job of contract programming, any information provided to the newly assigned individual which will help him or her learn the job faster will be of benefit to the individual as well as to the contract

programming office and the installation.

Objective of the Research

The objective of this research was to determine what general background information the current Air Force contract programmers in the field perceive should be included in a handbook designed to help new personnel learn the job of contract programming as quickly as possible. The approach to this study was to survey, using a questionnaire, the current Air Force contract programmers in the field. This research was intended to be the first step towards the publication of a handbook for new contract programmers.

Scope and Limitations of Study

The scope of this study is limited to the following items:

1. The perceptions of U.S. Air Force base level and MAJCOM level civil engineering contract programmers within the continental United States (CONUS).

2. The role of the contract programmer in a peacetime environment.

3. The collection and tabulation of information obtained from the questionnaires into lists identifying the information needed to help new contract programmers learn the job as quickly as possible.

4. Preparation of a list of information topic areas which could be included in a handbook.

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Assumptions

This research effort is based upon the following two assumptions:

1. Information collected from the current experienced and inexperienced Air Force base level and MAJCOM level contract programmers in the CONUS is adequate to solve the research problem.

2. The information collected will identify what general background information an individual who has no prior experience at contract programming needs to learn the job as quickly as possible.

II. Background

Introduction

The U.S. Air Force is charged with the responsibility
for accomplishing the following:

> The Air Force prepares aerospace forces to
> perform offensive and defensive operations with
> the purpose of defending the United States,
> deterring aggression, and being ready to conduct
> warfare to support national objectives (1:3-1).

It executes this tasking through the accomplishment of
various missions. Each of the U.S. Air Force bases located
throughout the world is responsible for accomplishing one or
more of these missions. These missions may involve support
for weapon systems such as tactical fighters, strategic
missiles, or long range bombers or support for personnel
training, radar surveillance, and other areas.

This chapter begins with a presentation of the
organizational structure of a typical Air Force base that is
responsible for accomplishing a flying mission. Then a
brief presentation of the organizational structure, roles,
and responsibilities of the base civil engineering
organization is presented. This is followed by a discussion
of the job of contract programming. The goal of this
chapter is to help an individual who is unfamiliar with Air
Force civil engineering to better understand the role that
civil engineering, and ultimately the contract programmer,
plays in supporting the Air Force mission(s) of the base.

Overview

The major organizational element for a typical Air Force base with a flying mission is the "Wing". The Wing Commander is the senior individual responsible for ensuring that the assigned aircraft (e.g., tactical fighters, long range bombers, etc.) are mission capable; that is, ready to launch and capable of accomplishing the mission. He accomplishes this with the support of personnel who work directly for him as well as with the support of personnel in other organizations on the base.

The wing is comprised of subordinate units which are organized under four main functional areas: aircraft operations, aircraft maintenance, resource management, and combat support. The Combat Support Group Commander is responsible for providing essential base support services. Security police, base civil engineering, and the Judge Advocate General are among the organizations which comprise the Combat Support Group.

Base Civil Engineering

The primary mission of the base civil engineering organization is to

> provide the necessary assets and skilled
> personnel to prepare and sustain global
> installations as stationary platforms for the
> projection of aerospace power in peace and war
> (2:2).

The base civil engineer (BCE) is responsible for maintaining, repairing, and replacing facilities and

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utilities (water, gas, electricity, etc.) located on the
base. In addition, the BCE provides fire protection,
manages and maintains military family housing on the base
and provides other services as well (13:1-2).

The BCE organization is made up of eight branches:
Readiness Management, Industrial Engineering, Family Housing
Management, Squadron Section and Administration, Financial
Management, Fire Protection, Operations, and Engineering and
Environmental Planning (6:3).

The Readiness Management branch is responsible for
ensuring that civil engineering personnel are properly
trained and equipped to respond to natural disasters, major
accidents and most importantly, contingency situations
(combat).

The Industrial Engineering branch "is responsible for
evaluating the quality of work performed by all civil
engineering personnel" (13:5). The industrial engineer
looks for more effective and efficient ways for civil
engineering personnel to do their jobs.

The Family Housing Management branch manages on-base
housing maintenance and assignments and maintains current
information on off-base housing that is available within the
local area of the base.

The Squadron Section and Administration branch handles
personnel matters within the civil engineering organization.
They control the administrative work involved with
disciplinary actions, awards, evaluation reports, and other

matters pertaining to personnel within the organization.

The Financial Management branch maintains control over the receipt and expenditure of funds within the organization.

The Fire Protection branch functions as the base fire department. Fire detection, suppression and crash rescue capabilities are provided by this branch. In addition, fire prevention training is also conducted for all base personnel.

The Operations branch of civil engineering is typically the largest branch in terms of personnel assigned. It is responsible for the day-to-day maintenance and repair of the facilities and utilities on the base. Work requirements which exceed the capabilities of this branch in terms of scope, cost or expertise are usually accomplished by contract through the Engineering and Environmental Planning branch.

The Engineering and Environmental Planning branch is made up of four sections: Engineering, Contract Management, Real Estate Management, and Environmental and Contract Planning.

The Engineering section is responsible for the technical design of maintenance, repair, construction and service contract projects. This includes preparing specifications, drawings, cost estimates and statements of work for the projects.

The Contract Management section is responsible for

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ensuring that work done by contractors is adequate and acceptable to the government.

The Real Estate Management section is responsible for maintaining and updating real estate records pertaining to base land use and facilities.

The Environmental and Contract Planning section's responsibilities include the management of environmental resources (land, water and air quality and hazardous waste disposal), the preparation and implementation of the base comprehensive plan, and the programming of maintenance, repair, construction and service contract projects. The contract programmer is assigned to this section.

Contract Programming

Air Force Regulation (AFR) 85-10, Operation and Maintenance of Real Property, defines the job of contract programming as follows:

> (1) Establishes and maintains facility requirements needed to accomplish the installation mission.
>
> (2) Develops programming documents for the construction, maintenance, and repair of real property facilities.
>
> (3) Develops and performs status reporting and control of related projects [2:2].

Furthermore, AFR 85-10, Attachment 1 continues:

> Contract planning [programming] prepares and maintains plans and programs for all work done by contract (i.e., MFH, NAF, MCP, O&M, etc.).
>
> Prepares DD Forms 1391/1391c and submits to higher headquarters based on funding needs.

Identifies to the funds manager budget
information for contract requirements [2:14].

This regulation also refers to the requirement
"Prepares and maintains the Maintenance, Repair and Minor
Construction Program Report (MAREMIC)" (2:14). Since the
regulation was published, MAREMIC has been replaced by the
Civil Engineering Contract Reporting System (CECORS) which
is prepared and maintained by the contract programmer.
CECORS is a computer based management information system
which contains data on all projects identified for contract
accomplishment (present and future).

As stated previously, contract programmers collect
information and prepare documentation to support such vital
programs as the Military Construction Program and the
Operations and Maintenance Program for the various bases.
These programs, along with others, result in the
maintenance, repair, and construction of facilities and
utilities located throughout the Air Force. These programs
are necessary to ensure that present and future mission
requirements for the base are met.

The following is an example of how a contract
programmer might program a project. The example is meant to
reflect a typical situation whereas the actual programming
process may vary from base to base.

The base supply officer has identified a need for an
additional warehouse to store spare parts and supplies for
the tactical aircraft assigned to the base. He submits his

request, in writing, for a new facility (including approximate size and justification for the warehouse) to the base civil engineering squadron.

The request is received and evaluated by personnel in the Requirements section in the Operations branch of the BCE organization. It is determined that the Operations branch does not have the capability (time, manpower, approval authority) to accomplish the request. The request is then forwarded to the contract planning section for contract accomplishment.

The contract programmer receives the request and verifies that the size of the facility requested falls within the acceptable Air Force guidelines. He then coordinates with the Real Estate Management section to determine whether or not another facility on the base, not currently in use or only partially occupied, can be used as a warehouse. If no suitable facility can be found, he begins programming the project.

The contract programmer classifies the project as to the type of work to be accomplished and determines the programming avenue (funds source) to be used. In this example, the project would be classified as construction and if it is large enough in terms of cost, would probably require Military Construction Program (MCP) funding.

Next, the contract programmer prepares a preliminary cost estimate for the project. He then prepares the programming documents (DD Form 1391/1391c) which include the

cost, size, description of construction, and justification for the project.

The project is then placed in the existing MCP project list which contains other projects previously identified and programmed for the base. This list is then presented to the base Facilities Board which is chaired by the wing commander. The Facilities Board determines the relative priority of the projects, placing those projects most critical to mission accomplishment higher on the list. Seldom, if ever, does a base receive sufficient funds to construct all projects identified for a given fiscal year; therefore the need to prioritize the projects.

After the project has been prioritized by the Facilities Board, the contract programmer accomplishes additional documentation, such as environmental and economic analyses, cost estimate refinements, and site plans. This documentation is then submitted to higher headquarters. Typically, the programmer working this program may have up to 40 projects at any one time in a five year program, with each fiscal year's projects undergoing a different phase of project documentation.

This simple example of project programming was presented to give the reader an idea of the work done by a contract programmer for one type of programming avenue (MCP). The actual programming process is much more complicated and diverse, requiring various types of documentation and usually requiring other sections and

branches of civil engineering, along with other base
organizations, to participate in the process.

Summary

Contract programmers work in the Environmental and
Contract Planning section of the base civil engineering
squadron. Contract programmers are tasked with collecting
information and preparing documentation to support facility
projects which are vital to the mission of the base.
Contract programmers are also responsible for maintaining
lists of projects by programming avenue to be accomplished
by contract for the base. Contract programmers function as
engineers and as liaisons between civil engineering and
other base organizations.

III. Methodology

Introduction

This chapter describes the approach and techniques used to answer the research objective stated in Chapter I: What general background information do current Air Force contract programmers in the field perceive should be included in a handbook designed to help new personnel learn the job of contract programming as quickly as possible?

Population

The population of interest in this research consisted of all base level and MAJCOM level civil engineering contract programmers stationed in the continental United States (CONUS). This population consisted of military personnel in the grades of E-7 to O-5 and civilian personnel in the grades of GS-7 to GM-14. The exact number of each of these types of personnel was not readily available because the job of contract programming does not have a unique military Air Force Specialty Code (AFSC) nor a unique civilian numerical identifier. Therefore, the population was determined by survey.

A letter of request was mailed to each of the Air Force bases in the CONUS. Letters were addressed to the Base Civil Engineering squadron commander at each base and the Deputy Chief of Staff for Engineering and Services of each of the major commands headquartered in the CONUS, requesting

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that they provide the names of the contract programmers on their staffs. Of the 89 letters mailed out, 82 letters were returned, resulting in the identification of 61 military and 174 civilian contract programmers. The distribution of the programmers, by MAJCOM level and base level, is presented in Appendix A.

Survey Instrument

The survey instrument (a questionnaire) used in the research was devised by the author using knowledge gained from a review of the current literature (1980 to 1985) about questionnaires. Using his own experience as a contract programmer, he determined what specific information should be included in the questionnaire. A review of the literature concerning the definition, design, and construction of a questionnaire is presented in Appendix B.

The author pretested the questionnaire using personnel at the AFIT School of Civil Engineering. The questionnaire was administered to the 34 personnel enrolled in the Project Programming course (MGT 023) which was held during the period 3 Feb 86 to 12 Feb 86. This course is available to and attended by contract programmers from throughout the Air Force. The results of the pretest indicated the questionnaire was adequate for its intended purpose and did not require any revisions.

The questionnaire was then submitted to the Air Force Manpower and Personnel Center (AFMPC) at Randolph Air Force

Base, Texas for Air Force approval. AFMPC forwarded a copy
of the questionnaire to the Office of Civilian Personnel
Operations (OCPO), also located at Randolph AFB (approval of
OCPO is required when surveying Air Force civilians).
Written notification of approval from both organizations was
received on 8 April 1986. However, full approval was
contingent upon two recommendations.

The first recommendation came from OCPO and required
the author to submit information copies of the questionnaire
and approval letter to the base level Civilian Personnel
Labor Management Relations office at each base to be
surveyed. The second recommendation came from AFMPC and
required the author to change the rating scale used in the
questionnaire. Both of these recommendations were
accomplished and the final survey questionnaire was
prepared. This questionnaire is presented in Appendix C.

Data Collection

The questionnaires were mailed out to the military
contract programmers and civilian personnel offices
concurrently. Ten working days were allowed for the
civilian personnel offices to respond to the questionnaire
should they have any questions or problems. Five civilian
personnel offices responded with telephone calls to the
author. Their questions were easily resolved. However, a
sixth civilian personnel office, located at Kirtland AFB New
Mexico, disapproved by written notification the

administering of the questionnaire to any of the civilian
contract programmers on that base. Therefore, the six
personnel at that base were not surveyed. The
questionnaires for the rest of the civilian personnel were
mailed out at the end of the ten-day period.

Survey Response

Two hundred twenty nine surveys were mailed to the
population during the period 5 May 1986 to 30 May 1986. By
the cutoff date of 16 June 1986, 198 surveys had been
returned, for a return rate of 86.5%. Five of these surveys
were invalid because they were not properly filled out.

Data Analysis

The information collected through the questionnaire
consisted of three parts. The first part was demographic
data, which included the personnel status (i.e., military or
civilian), command level (i.e., MAJCOM or base level), and
job experience (i.e., time in the job) of the personnel
surveyed. The second part consisted of the personal
opinions of the survey participants as to their degree of
recommendation or nonrecommendation to include information
items (topic areas) listed in the questionnaire in a
handbook. The third part of the questionnaire allowed the
survey participants to add additional information items
which they felt should be included in a handbook.

The analysis of the demographic data from Part I of the
questionnaire identified 16 different types of survey

participants (e.g., MAJCOM civilian with over 18 months
experience; base level military with 0-6 months of
experience, etc.). This information was used to determine
some general characteristics of the population of contract
programming personnel presently located at the CONUS based
Air Force installations.

The analysis of Part II of the questionnaire consisted
of three parts. Before describing these parts, two
assumptions about the data collected must be addressed.

There are four levels of measurement for characterizing
data: nominal, ordinal, interval, and ratio. These levels
determine the type of statistical testing that can be done
with the data (12:36). The data derived from Part II of the
questionnaire is characterized as ordinal level data (4:90).
The data can be ranked according to degree of recommendation
or nonrecommendation; however, the distance between the
degrees is not measured. If the distance was measured, then
the level of measurement would be interval.

There is disagreement among the behavioral sciences
researchers as to whether or not parametric tests (i.e.,
difference of means) can be conducted using ordinal level
data because the distance between the rankings is not
measured (4:89-90). For the purpose of this research, the
distance (interval) between the rankings (degrees) is
assumed to be equal. This allows the data to be treated as
interval level data and parametric tests are then permitted.
This assumption is supported by Nie (11:6). He notes that

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"except for extreme situations, interval statistics can be applied to any ordinal-level variable" (11:6).

The second assumption that must be made pertains to the probability distribution of the data. The central limit theorem allows the researcher to assume that the distribution is normal provided the sample size is greater than 30 (3:198-201). Since the sample size for this research group was 193, a normal distribution was assumed.

The first part of the analysis of Part II consisted of the tabulation of the frequencies of the question responses collected from the sample population. The arithmetic or sample mean of the frequencies for each question response was then calculated (7:16).

The sample mean of the frequencies was calculated by multiplying the number of responses for each question by their respective scale values (1,2,3,4 or 5), summing these results, and dividing the sum by the total number of responses for that question.

The questions (topic areas) were then listed in order of emphasis (rank ordered) from most "strongly recommended" to least "recommended" as determined by the value of their respective means. The purpose of the rank ordering was to determine which topic areas the survey respondents considered the most important for the new contract programmer to learn.

Finally, the arithmetic mean and standard deviation of the sample means were calculated. The purpose of this

analysis was to determine whether or not the sample mean of any of the topic areas was significantly different from the arithmetic mean of the sample means. A sample mean was considered significantly different if its value varied from the arithmetic mean value of the sample means by plus or minus two or more standard deviations. This measurement was chosen because the probability of it occurring is .05. Therefore, its occurrence would imply that the topic area with that sample mean is either recommended significantly higher or lower than the rest of the topic areas.

The second part of the analysis involved dividing the population into two groups: personnel with less than one year of experience in the job and personnel with more than one year of experience. Tabulation of frequencies, arithmetic means, and order of emphasis listings were again accomplished--this time by group instead of by total sample population. The purpose of this analysis was to determine whether or not job experience affected the order of emphasis placed on the topic areas.

Next, a "Z" test for the "difference of sample means" was conducted (7:171). This test determines whether or not there is a statistically significant difference between the sample mean of a topic area on one list versus the sample mean of the same topic area on another list. A significance level (probability of determining that there is a difference between the means when in reality there is not) of .05 was chosen (3:239). This level allows for 95 percent confidence

in the accuracy of the test results. The results of this test determined whether or not there was a significant difference between the two groups in the degree of recommendation placed upon each topic area.

The third part of the analysis involved the same procedures as the second part, but the total sample population was divided into two different groups: MAJCOM personnel and base level personnel. The purpose of this analysis was to determine whether or not the level of command affected the order of emphasis placed upon the topic areas. The analysis also determined whether or not there was a significant difference (difference of sample means using a significance level of .05) between the two groups in the degree of recommendation placed upon each topic area.

The analysis of Part III of the questionnaire involved listing the suggested additional topic areas and tabulating the frequency of responses for each area. If 30 or more of the 193 respondents listed the topic area, then it was included in the recommended list of topic areas for the handbook. This figure was chosen by the author after evaluating the list of suggested additional topic areas and their frequencies and determining a significant break point in the distribution of the frequencies (10:57). Those additional topic areas not chosen to be included in the handbook were evaluated using content analysis.

Content analysis was used to determine whether or not the suggested additional topic areas could be grouped

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together according to similar content and either considered
additions to the topic areas already identified in the
questionnaire or formed into fewer but larger topic areas.
Content analysis was accomplished using the researcher's
judgment and was based on the researcher's knowledge of the
subject (10:60).

IV. Results and Analysis

Introduction

This chapter presents the results of the survey. It begins with a discussion of the demographic profile of the population as determined by the participants' responses to Part I of the survey. Several analyses are then presented to show a comparison of the responses of the various types of participants to Part II of the survey. Finally, an analysis of the open-ended response portion of the survey (Part III) is presented.

Demographics

Part I of the survey requested that the participants provide demographic data about themselves. The results of this part of the survey are presented in Table I.

Table I shows the population separated into two large categories; major command personnel (MAJCOM) and base level personnel. These categories are then divided into civilian and military personnel. Finally, the population is further categorized according to the participants' job experience.

Closed-ended Response Analysis

Part II of the survey consisted of a closed-ended response format. It asked the participants to provide their opinions about whether or not the particular topic areas listed in the questionnaire should be included in a

TABLE I

Population Characteristics

Experience	MAJCOM		Base Level	
	Civilian	Military	Civilian	Military
18 months & over	24	4	71	12
12 - 18 months	2	2	8	9
6 - 12 months	2	3	16	10
0 - 6 months	1	3	17	9
Total	29	12	112	40

handbook. The results of this part of the survey are
presented in Table II.

As the table shows, the majority of the survey
participants at least "recommended" (frequency of response
for scale value of 4 or 5 greater than frequency of response
for any other scale value) the inclusion of all 14 topic
areas listed in the questionnaire in a handbook.

The analysis of the results began with the
determination of the order of emphasis (rank order) of the
topic areas. The order, as determined by the means of the
frequencies of responses, is presented in Table III. Next,
the standard deviation and arithmetic mean of the mean
values listed in Table III were calculated. These values
are .319 and 4.197 respectively. None of the mean values of
the responses listed in Table III varied from the value

TABLE II

Response by Total Population
(Frequencies)

Topic Area	*(1)	(2)	(3)	(4)	(5)
Air Force Regulations	3	1	5	67	117
Airfield, Noise and Explosive Safety Waivers	2	11	41	89	50
Approval Authorities	2	1	5	45	140
Base Master Planning	3	5	34	110	41
Civil Engineering Contract Reporting System (CECORS)	1	3	9	63	117
Construction Cost Estimating	1	8	10	85	89
Economic Analysis	1	8	22	98	64
Environmental Planning	3	8	33	120	29
Facilities Board	1	1	7	87	97
Planning, Programming, and Budgeting System	4	14	28	89	58
Programming Avenues	1	2	2	46	142
Project Books	4	11	34	96	48
Project Identification	1	9	16	98	69
Real Estate	1	14	36	114	28

* SCALE: (1) Strongly do not recommend
(2) Do not recommend
(3) Don't know/No opinion
(4) Recommend
(5) Strongly recommend

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Table III

Order of Emphasis as Suggested by the Total Population

Rank	Topic Area	*Mean Value
1	Programming Avenues	4.689
2	Approval Authorities	4.658
3	Air Force Regulations	4.523
4	Civil Engineering Contract Reporting System (CECORS)	4.513
5	Facilities Board	4.440
6	Construction Cost Estimating	4.311
7	Project Identification	4.166
8	Economic Analysis	4.119
9	Planning, Programming, and Budgeting System	3.948
10	Base Master Planning	3.938
11	Airfield, Noise and Explosive Safety Waivers	3.902
12	Project Books	3.896
13	Environmental Planning	3.850
14	Real Estate	3.798

* Mean value is the arithmetic mean of the responses as determined by multiplying the number of responses by their respective scale values, summing these results, and dividing the sum by the total number of responses.

of the arithmetic mean of the mean values by plus or minus
two or more standard deviations (i.e., greater than 4.835 or
less than 3.559 respectively). Therefore, none of the topic
areas was recommended significantly higher or lower than the
other topic areas.

The next part of the analysis involved dividing the
population into various groups to determine whether or not
the participants' job experience or level of command (MAJCOM
or base level) influenced the order of emphasis or degree of
recommendation placed upon the topic areas.

First, the population was categorized according to the
participants' job experience. The participants were divided
into two groups: those with more than one year of experience
in the job and those with less than one year of experience.
The distribution of their responses is presented in Tables
IV and V respectively. Each group at least "recommended"
the inclusion of all 14 topic areas.

The order of emphasis of the topic areas, by group, is
presented in Tables VI and VII. The order of emphasis was
very similar between the two groups with the exception of
three topic areas: Airfield, Noise, and Explosive Safety
Waivers, Environmental Planning, and Project Books.
Personnel with more than one year of experience in the job
ranked Airfield, Noise, and Explosive Safety Waivers higher
in emphasis and Environmental Planning and Project Books
lower in emphasis than did the personnel with less than one
year of experience in the job.

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TABLE IV

Response by Personnel With More Than 1 Year
of Experience in Job
(Frequencies)

Topic Area	*(1)	(2)	(3)	(4)	(5)
Air Force Regulations	3	1	5	43	80
Airfield, Noise and Explosive Safety Waivers	2	4	29	61	36
Approval Authorities	2	0	2	31	97
Base Master Planning	3	3	23	78	25
Civil Engineering Contract Reporting System (CECORS)	1	2	7	46	76
Construction Cost Estimating	1	7	5	56	63
Economic Analysis	1	7	15	69	40
Environmental Planning	3	7	23	79	20
Facilities Board	1	1	6	61	63
Planning, Programming, and Budgeting System	3	9	19	62	39
Programming Avenues	1	0	2	30	99
Project Books	4	9	21	69	29
Project Identification	1	7	10	64	50
Real Estate	1	11	22	76	22

* SCALE: (1) Strongly do not recommend
(2) Do not recommend
(3) Don't know/No opinion
(4) Recommend
(5) Strongly recommend

TABLE V

Response by Personnel With Less Than 1 Year of Experience in Job
(Frequencies)

Topic Area	*(1)	(2)	(3)	(4)	(5)
Air Force Regulations	0	0	0	24	37
Airfield, Noise and Explosive Safety Waivers	0	7	12	28	14
Approval Authorities	0	1	3	14	43
Base Master Planning	0	2	11	32	16
Civil Engineering Contract Reporting System (CECORS)	0	1	2	17	41
Construction Cost Estimating	0	1	5	29	26
Economic Analysis	0	1	7	29	24
Environmental Planning	0	1	10	41	9
Facilities Board	0	0	1	26	34
Planning, Programming, and Budgeting System	1	5	9	27	19
Programming Avenues	0	2	0	16	43
Project Books	0	2	13	27	19
Project Identification	0	2	6	34	19
Real Estate	0	3	14	38	6

* SCALE:
(1) Strongly do not recommend
(2) Do not recommend
(3) Don't know/No opinion
(4) Recommend
(5) Strongly recommend

Table VI

Order of Emphasis as Suggested by Personnel With More Than 1 Year of Experience in Job

Rank	Topic Area	*Mean Value
1	Programming Avenues	4.712
2	Approval Authorities	4.674
3	Air Force Regulations	4.485
4	Civil Engineering Contract Reporting System (CECORS)	4.470
5	Facilities Board	4.394
6	Construction Cost Estimating	4.311
7	Project Identification	4.174
8	Economic Analysis	4.061
9	Airfield, Noise and Explosive Safety Waivers	3.947
9	Planning, Programming, and Budgeting System	3.947
11	Base Master Planning	3.902
12	Project Books	3.833
13	Real Estate	3.811
14	Environmental Planning	3.803

* Mean value is the arithmetic mean of the responses as determined by multiplying the number of responses by their respective scale values, summing these results, and dividing the sum by the total number of responses.

Table VII

Order of Emphasis as Suggested by Personnel With
Less Than 1 Year of Experience in Job

Rank	Topic Area	*Mean Value
1	Programming Avenues	4.639
2	Approval Authorities	4.623
3	Air Force Regulations	4.607
3	Civil Engineering Contract Reporting System (CECORS)	4.607
5	Facilities Board	4.541
6	Construction Cost Estimating	4.311
7	Economic Analysis	4.246
8	Project Identification	4.148
9	Project Books	4.033
10	Base Master Planning	4.016
11	Environmental Planning	3.951
11	Planning, Programming, and Budgeting System	3.951
13	Airfield, Noise and Explosive Safety Waivers	3.803
14	Real Estate	3.770

* Mean value is the arithmetic mean of the responses as determined by multiplying the number of responses by their respective scale values, summing these results, and dividing the sum by the total number of responses.

The standard deviation and arithmetic mean of the mean values listed in Table VI were calculated to be .324 and 4.180 respectively. The values for Table VII were calculated to be .307 and 4.191 respectively. The range of values (arithmetic mean plus or minus two standard deviations) was calculated to be 3.532 to 4.828 for Table VI and 3.577 to 4.805 for Table VII. In neither case did any of the mean values listed in the tables exceed the range of values for their respective table. Therefore, neither group recommended any topic area significantly higher or lower than the other topic areas.

The "difference of sample means" test for the two groups, by topic area, revealed that there was no significant difference in the degree of recommendation between the groups. These results are presented in Table VIII. An explanation of how these figures were obtained is presented in Appendix D.

Next, the total population was categorized according to the participants' level of command. The participants were divided into two groups: MAJCOM personnel and base level personnel. The distribution of their responses is presented in Tables IX and X respectively. Each group at least "recommended" the inclusion of all 14 topic areas.

The order of emphasis of the topic areas, by group, is presented in Tables XI and XII. The order of emphasis was very similar between the two groups with the exception of three topic areas: Construction Cost Estimating, Planning,

TABLE VIII

Difference of Sample Means Test Between
Levels of Job Experience

Topic Area	* Mean Values		** Z Value
Air Force Regulations	4.485	4.607	-1.29
Airfield, Noise and Explosive Safety Waivers	3.947	3.803	1.02
Approval Authorities	4.674	4.623	.50
Base Master Planning	3.902	4.016	-.95
Civil Engineering Contract Reporting System (CECORS)	4.470	4.607	-1.32
Construction Cost Estimating	4.311	4.311	0.00
Economic Analysis	4.061	4.246	-1.57
Environmental Planning	3.803	3.951	-1.37
Facilities Board	4.394	4.541	-1.62
Planning, Programming, and Budgeting System	3.947	3.951	-.03
Programming Avenues	4.712	4.639	.74
Project Books	3.833	4.033	-1.50
Project Identification	4.174	4.148	.22
Real Estate	3.811	3.770	.36

* Mean Values from Tables VI and VII respectively.

** The difference between sample means is considered significant if the Z Value is greater than 1.96 or less than -1.96.

Table IX

Response by MAJCOM Personnel
(Frequencies)

Topic Area	*(1)	(2)	(3)	(4)	(5)
Air Force Regulations	0	0	3	15	23
Airfield, Noise and Explosive Safety Waivers	1	1	11	21	7
Approval Authorities	0	0	1	11	29
Base Master Planning	1	0	8	26	6
Civil Engineering Contract Reporting System (CECORS)	0	1	4	16	20
Construction Cost Estimating	0	5	2	23	11
Economic Analysis	0	2	5	24	10
Environmental Planning	1	2	9	26	3
Facilities Board	0	0	1	22	18
Planning, Programming, and Budgeting System	0	4	4	17	16
Programming Avenues	0	0	0	10	31
Project Books	1	5	9	21	5
Project Identification	0	1	4	25	11
Real Estate	0	6	9	22	4

* SCALE:
(1) Strongly do not recommend
(2) Do not recommend
(3) Don't know/No opinion
(4) Recommend
(5) Strongly recommend

TABLE X

Response by Base Level Personnel
(Frequencies)

Topic Area	*(1)	(2)	(3)	(4)	(5)
Air Force Regulations	3	1	2	52	94
Airfield, Noise and Explosive Safety Waivers	1	10	30	68	43
Approval Authorities	2	1	4	34	111
Base Master Planning	2	5	26	84	35
Civil Engineering Contract Reporting System (CECORS)	1	2	5	47	97
Construction Cost Estimating	1	3	8	62	78
Economic Analysis	1	6	17	74	54
Environmental Planning	2	6	24	94	26
Facilities Board	1	1	6	65	79
Planning, Programming, and Budgeting System	4	10	24	72	42
Programming Avenues	1	2	2	36	111
Project Books	3	6	25	75	43
Project Identification	1	8	12	73	58
Real Estate	1	8	27	92	24

* SCALE: (1) Strongly do not recommend
          (2) Do not recommend
          (3) Don't know/No opinion
          (4) Recommend
          (5) Strongly recommend

Table XI

Order of Emphasis as Suggested by
MAJCOM Personnel

Rank	Topic Area	*Mean Value
1	Programming Avenues	4.756
2	Approval Authorities	4.683
3	Air Force Regulations	4.488
4	Facilities Board	4.415
5	Civil Engineering Contract Reporting System (CECORS)	4.341
6	Project Identification	4.122
7	Planning, Programming, and Budgeting System	4.098
8	Economic Analysis	4.024
9	Construction Cost Estimating	3.976
10	Base Master Planning	3.878
11	Airfield, Noise and Explosive Safety Waivers	3.780
12	Environmental Planning	3.683
13	Project Books	3.585
13	Real Estate	3.585

* Mean value is the arithmetic mean of the responses as determined by multiplying the number of responses by their respective scale values, summing these results, and dividing the sum by the total number of responses.

Table XII

Order of Emphasis as Suggested by Base Level Personnel

Rank	Topic Area	*Mean Value
1	Programming Avenues	4.671
2	Approval Authorities	4.651
3	Civil Engineering Contract Reporting System (CECORS)	4.559
4	Air Force Regulations	4.533
5	Facilities Board	4.447
6	Construction Cost Estimating	4.401
7	Project Identification	4.178
8	Economic Analysis	4.145
9	Project Books	3.980
10	Base Master Planning	3.954
11	Airfield, Noise and Explosive Safety Waivers	3.934
12	Planning, Programming, and Budgeting System	3.908
13	Environmental Planning	3.895
14	Real Estate	3.855

* Mean value is the arithmetic mean of the responses as determined by multiplying the number of responses by their respective scale values, summing these results, and dividing the sum by the total number of responses.

Programming, and Budgeting System, and Project Books.
MAJCOM personnel ranked Planning, Programming, and Budgeting
System higher in emphasis and Construction Cost Estimating
and Project Books lower in emphasis than did the base level
personnel.

The standard deviation and arithmetic mean of the mean
values listed in Table XI were calculated to be .388 and
4.101 respectively. The values for Table XII were
calculated to be .309 and 4.222 respectively. The range of
values (arithmetic mean plus or minus two standard
deviations) was calculated to be 3.325 to 4.877 for Table XI
and 3.604 to 4.840 for Table XII. In neither case did any
of the mean values listed in the tables exceed the range of
values for their respective table. Therefore neither group
recommended any topic area significantly higher or lower
than the other topic areas.

The "difference of sample means" test for the two
groups, by topic area, revealed that there was a significant
difference in the degree of recommendation between the
groups concerning Construction Cost Estimating and Project
Books. These results are presented in Table XIII.

Open-ended Response Analysis

Part III of the survey consisted of an open-ended
response format. It asked the participants to provide and
rate, as to degree of recommendation, additional topic areas
which they thought should be included in the handbook but

TABLE XIII

Difference of Sample Means Test Between
Levels of Command

Topic Area	* Mean Values		** Z Value
Air Force Regulations	4.488	4.533	-.39
Airfield, Noise and Explosive Safety Waivers	3.780	3.934	-1.04
Approval Authorities	4.683	4.651	.29
Base Master Planning	3.878	3.954	-.51
Civil Engineering Contract Reporting System (CECORS)	4.341	4.559	-1.68
Construction Cost Estimating	3.976	4.401	*** -2.76
Economic Analysis	4.024	4.145	-.89
Environmental Planning	3.683	3.895	-1.53
Facilities Board	4.415	4.447	-.32
Planning, Programming, and Budgeting System	4.098	3.908	1.14
Programming Avenues	4.756	4.671	1.00
Project Books	3.585	3.980	*** -2.40
Project Identification	4.122	4.178	-.44
Real Estate	3.585	3.855	-1.81

* Mean Values from Tables XI and XII respectively

** The difference between sample means is considered significant if the Z Value is greater than 1.96 or less than -1.96.

*** Significant difference

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were not already identified.

One hundred and one survey participants responded to this portion of the questionnaire. The responses were of three types: additional topic areas, specific information to be included in the topic areas identified, and specific guidance on how the handbook should be written. The two latter types of responses are presented in Appendix E.

The suggested additional topic areas and their associated frequencies of response are shown in Table XIV. The first column of the table shows the suggested additional topic areas. The second column shows the frequencies of responses according to the scale value (4 or 5) given to the topic area by the respondents. The final column is the total number of responses for the topic area. The topic areas are listed in decreasing order by total number of responses. No significance is implied by the order of the list where topic areas with equal frequencies of response are listed.

The first part of the analysis of open-ended responses consisted of determining whether or not any of the suggested additional topic areas had a frequency of response which met the criteria presented in Chapter III (frequency of response of 30 or more). Only one topic area, Importance of and Sample 1391/1391c Documents, met this criteria.

The second part of the analysis was accomplished using content analysis. The author evaluated the list of additional topic areas and grouped those with similar

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TABLE XIV

Suggested Additional Topic Areas
(Frequencies)

Topic Area	*4/5	Total
Importance of and sample 1391/1391c documents	6/29	35
Interrelationships between contract programmers and other sections in civil engineering squadron	3/9	12
Difference between types of work classifications (i.e., repair, alteration, maintenance, etc.)	1/10	11
MCP approval process (flow and timing)	1/10	11
How to calculate and justify space and/or facility requirements	2/9	11
Interrelationships between contract programmer and project requestor	1/7	8
Easy to read tables listing codes and approval limits used on 1391's which could be easily referenced by new programmers	0/3	3
Program Objectives Memorandum process	1/2	3
List of actual contract programmer's responsibilities	2/1	3
Site approval requirements and process	2/1	3
Procurement process	3/0	3
Explanation of O&M budget and relationship to contract programming	0/2	2
File system for programming guidance letters	0/2	2
WIMS use and computer skills	0/2	2
	(continued)	

* SCALE: (4) Recommend
(5) Strongly Recommend

TABLE XIV--Continued

Topic Area	*4/5	Total
PDC guide	0/2	2
Canned requirement, situation, and impact statements for different situations	0/2	2
Public law and DODIs dealing with DOD facility construction	0/2	2
Correspondence procedures: samples of letters, messages, point papers, staff summary sheets	0/2	2
Explanation of EEIC's	1/1	2
Quick reference dictionary of terms and abbreviations	1/1	2
What to keep in files (project and personal)	1/1	2
Tenant units, host-tenant agreements	1/1	2
Audit issues and how to handle an audit	1/1	2
The importance of a reliable source of current design status and construction status	0/1	1
Function of category codes	0/1	1
Provide stress management classes	0/1	1
How to combat pressure to misclassify work in an attempt to stay under the $200,000 minor construction limitation	0/1	1
How to straighten things out after they have gone through system (>35% design) and final project is entirely different than original work request both in scope and type of funding	0/1	1
Base level interface with MAJCOM personnel	0/1	1
	(continued)	

* SCALE: (4) Recommend
         (5) Strongly Recommend

TABLE XIV--Continued

Topic Area	*4/5	Total
Military career progression tie-in	0/1	1
BCE responsibility for maintaining non-real property shelters/systems	0/1	1
Prioritizing projects based on money projected to be available for funding	0/1	1
Recommended training for programmers	0/1	1
A job description of an MCP programmer	0/1	1
How to present and sell a project	0/1	1
Model Installation Program	0/1	1
MAJCOM technical assistant teams	0/1	1
Communications-electronic fund sources and responsibilities	0/1	1
AFOLDS retrieval system and how to use it	0/1	1
Mission and organization of the BCE organization	0/1	1
Describe concept of "Whole House Improvement"	0/1	1
For TAC bases - 26 NOV 85 TAC DE Letter (File # DE-416-85) Delegation of Project Approval Authority	0/1	1
HQ TAC Guidance Package on MCP 1391 preparation ("There's No Room for Error")	0/1	1
Explanation of the impact asbestos regulations have on contract programming	0/1	1
Development of work area layouts for projects	0/1	1

(continued)

* SCALE: (4) Recommend
         (5) Strongly Recommend

TABLE XIV--_Continued_

Topic Area	*4/5	Total
Discussion of who's in charge - the base or the MAJCOM	0/1	1
International exchange rates and their affect on program costs overseas	0/1	1
Description of Project Life Cycle (conception to disposal)	1/0	1
Difference in statuatory versus regulatory limitations	1/0	1
Purchase Requests	1/0	1
Programming as a service to the customer (user)	1/0	1

* SCALE: (4)   Recommend
          (5)   Strongly Recommend

content together. The first 11 groups contain responses

associated with topic areas listed in Part II of the

questionnaire. The remaining three groups are new topic

areas. The groups are presented, in no significant order,

as follows:

    Group 1:   Approval Authorities

                Difference in statuatory versus regulatory
                  limitations
                For TAC bases - 26 NOV 85 TAC DE Letter
                  (File # DE-416-85) Delegation of Project
                  Approval Authority

    Group 2:   Base Master Planning

                Site approval requirements and process

Group 3: Civil Engineering Contract Reporting System

WIMS use and computer skills
AFOLDS retrieval system and how to use it

Group 4: Economic Analysis

Description of Project Life Cycle
   (conception to disposal)

Group 5: Environmental Planning

Explanation of the impact asbestos
   regulations have on contract programming

Group 6: Facilities Board

Prioritizing projects based on money
   projected to be available for funding

Group 7: Planning, Programming, and Budgeting System

MCP approval process (flow and timing)
Program Objectives Memorandum process
Explanation of O&M budget and relationship
   to contract programming
Explanation of EEIC's

Group 8: Programming Avenues

Difference between types of work
   classifications (i.e., repair, alteration,
   maintenance, etc.)
Communications-electronic fund sources and
   responsibilities

Group 9: Project Identification

Interrelationships between contract
   programmer and project requestor

Group 10: Real Estate

Function of category codes

Group 11: Importance of and Sample 1391/1391c Documents

How to calculate and justify space and/or
   facility requirements
Canned requirement, situation, and impact
   statements for different situations
HQ TAC Guidance Package on MCP 1391
   preparation ("There's No Room for Error")

Group 12:   Base Civil Engineering Organization

Interrelationships between contract
  programmers and other sections in civil
  engineering squadron
List of actual contract programmer's
  responsibilities
The importance of a reliable source of
  current design status and construction
  status
Base level interface with MAJCOM personnel
BCE responsibility for maintaining non-real
  property shelters/systems
A job description of an MCP programmer
Mission and organization of the BCE
  organization
Discussion of who's in charge - the base or
  the MAJCOM
Programming as a service to the customer
  (user)

Group 13:   Project Funding

Procurement process
International exchange rates and their
  affect on program costs overseas
Purchase Requests

Group 14:   Personal Aids and Guidance

Easy to read tables listing codes and
  approval limits used on 1391's which could
  be easily referenced by new programmers
File system for programming guidance letters
Correspondence procedures: samples of
  letters, messages, point papers, staff
  summary sheets
Quick reference dictionary of terms and
  abbreviations
What to keep in files (project and personal)
Provide stress management classes
How to combat pressure to misclassify work
  in an attempt to stay under the $200,000
  minor construction limitation
How to straighten things out after they have
  gone through system (>35% design) and
  final project is entirely different than
  original work request both in scope and
  type of funding
Military career progression tie-in
Recommended training for programmers
How to present and sell a project

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The remaining eight suggested additional topic areas in Table XIV did not appear to be similar in content to any of the other topic areas and therefore remain as single topic areas. They are:

Tenant units, host-tenant agreements

Audit issues and how to handle an audit

Model Installation Program

MAJCOM technical assistant teams

Describe concept of "Whole House Improvement"

Development of work area layouts for projects

PDC guide

Public law and DODIs dealing with DOD facility construction

V. Conclusions and Recommendations

Introduction

The objective of this research was to determine what general background information the current Air Force contract programmers in the field perceive should be included in a handbook designed to help new personnel learn the job of contract programming as quickly as possible.

This chapter will present the conclusions drawn from the analyses performed on the survey data. It will then present the author's recommendations for what general information should be included in the handbook and why. These recommendations are based on the results and analysis of the survey data. The chapter will conclude with recommendations for future research.

Conclusions

The questionnaire return rate for this research was 86.5%. This high rate of return indicates that the interest is high among the contract programmers in the field concerning the development of a handbook for new contract programmers. If the contract programmers had not perceived a need for the handbook, they probably would not have responded to the survey in the manner that they did.

The results for Part II of the questionnaire show that regardless of whether or not the population was evaluated as a whole or in smaller groups, the survey respondents at

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least recommended the inclusion of all 14 topic areas listed in the questionnaire. It appears then, that these 14 topic areas are the minimum number of topic areas to be included in the handbook.

The next observation is that regardless of how the population was grouped, the five highest ranked topic areas remained the same: Programming Avenues, Approval Authorities, Air Force Regulations, Civil Engineering Contract Reporting System, and Facilities Board. It can be assumed that these topic areas are the most important for the new contract programmer to learn and probably require the majority of his time in the job.

The lowest rank ordered topic area (i.e., rank order of 13 or 14), regardless of grouping, was consistently Real Estate. This indicates that this topic area does not play a major role in the job of contract programming.

None of the groups recommended any of the topic areas significantly higher or lower than the other topic areas. Therefore, the majority of the topic areas should receive approximately equal emphasis in the handbook.

When the population was separated into two groups according to their job experience (time in the job), no significant difference was determined between the groups as to their degree of recommendation for any one topic area. However, the two groups did disagree on the order of emphasis for three topic areas.

Personnel with more than one year of experience in the

job placed a greater emphasis on the need for the topic area Airfield, Noise, and Explosive Safety Waivers than did the personnel with less than one year of experience. These types of waivers are not required for every project; therefore, it can be assumed that personnel with less than one year of experience may not have been exposed to the requirement for these waivers while personnel with more experience probably have. Personnel with less experience would therefore not see a need to emphasize the topic area as much.

Personnel with more than one year of experience did not place as great an emphasis on two areas, Environmental Planning and Project Books, as did the personnel with less experience. This difference can perhaps be explained by the fact that environmental planning and project books are often accomplished (depending on the base) by other sections within the BCE organization. Thus, personnel with more than one year of experience, knowing that these areas may be accomplished by other sections within the BCE organization, would not emphasize them as much. Conversely, personnel with less than one year of experience apparently realize the importance of these topic areas, but may not realize who is responsible for accomplishing them.

When the population was separated into two different groups according to their level of command (MAJCOM or base level), significant differences were determined between the groups as to their degree of recommendation for two areas.

The two groups also disagreed on the order of emphasis for these two areas as well as the order of emphasis for a third area.

Base level personnel placed a greater emphasis and higher degree of recommendation on the need to include the topic areas of Construction Cost Estimating and Project Books than did the MAJCOM level personnel. MAJCOM programming personnel do not normally accomplish construction cost estimates and project books. They do however, review the estimates and project books submitted to them by the base level personnel. Therefore, it stands to reason that MAJCOM personnel would not see a need to emphasize these areas to the same degree as did the base level personnel.

MAJCOM personnel placed a greater emphasis on the need to include the topic area of Planning, Programming, and Budgeting System (PPBS) than did the base level personnel. This difference may have been caused by the wording on the questionnaire. The questionnaire referred to what PPBS is at the national level. Base level personnel may have keyed on the words "national level" and did not see a need to emphasize such a broad topic. Another possible conclusion is that the MAJCOM personnel saw a greater need to include this topic area because they are more directly involved in the entire PPBS while the base level programmers participate primarily in the programming phase.

Part III of the survey asked the respondents to provide

additional topic areas to be included in the handbook. The
results showed that one topic area, Importance of and Sample
1391/1391c Documents, had a frequency of response (35) that
was considerably higher than all other suggested topic areas
(frequency of response of 12 or less). Having met the
criteria contained in Chapter III, this topic area was
included in the recommended list of topic areas for the
handbook. The high frequency of response for this one topic
area directly reflects the perceived importance placed on
this area for the new contract programmer. As previously
stated, one of the responsibilities of the contract
programmer is to accomplish 1391/1391c documents.

The results of the content analysis performed on the
data collected from Part III of the survey showed that 23 of
the suggested additional topic areas focused on three major
issues that were not addressed in Part II of the survey. A
perceived need for the new contract programmer to be aware
of the roles and responsibilities of the entire base civil
engineering organization was clearly evident. In addition,
an awareness of the process of project funding and the value
of possessing personal files containing reference materials
for the job were identified.

Recommendations

The results of this research have shown that a handbook
designed to help new personnel learn the job of contract
programming as quickly as possible is needed and should

include at least 15 topic areas. Since the responses to the questionnaire were based on the descriptions given for each topic area listed in the questionnaire, it is recommended that these descriptions be used as a guide when determining what specific information to put into the handbook.

The following is the list of the 14 original topic areas and their descriptions as stated on the questionnaire. The fifteenth topic area is listed with the author's recommended description for it.

1. Air Force Regulations. A listing and description of the regulations and manuals applicable to contract programming.

2. Airfield, Noise, and Explosive Safety Waivers. A description of what each of these waivers is, their purpose, and why the contract programmer must know about them.

3. Approval Authorities. A description of what approval authorities are, their legal aspects, and how they impact the programming process.

4. Base Master Planning. A description of what base master planning is, its makeup and function, and how the contract programmer interfaces with it.

5. Civil Engineering Contract Reporting System (CECORS). A description of what CECORS is, its purpose, what information it provides, and what the contract programmer would use the information for.

6. Construction Cost Estimating. A description of
    the various methods of cost estimating (i.e.,
    like structure, square foot costing, systems
    costing, unit pricing) and the role of the
    contract programmer in the preparation of a cost
    estimate.

7. Economic Analysis. A description of what an
    economic analysis is, its purpose, and the role of
    the contract programmer in the preparation of one.

8. Environmental Planning. A description of what
    environmental planning is, its purpose, and how
    the contract programmer interfaces with it.

9. Facilities Board. A description of what the
    facilities board is, its makeup and function, and
    the role of the contract programmer in preparing
    for one.

10. Planning, Programming, and Budgeting System. A
    description of what the planning, programming, and
    budgeting system at the national level is, its
    makeup and function, and how the contract
    programmer interfaces with it.

11. Programming Avenues. A description of the various
    programming avenues (i.e., Military Construction
    Program, Operations and Maintenance Program, etc.)
    including the type of work they support and their
    limitations.

12. Project Books. A description of what project books are, their purpose, and the role of the contract programmer in the preparation of them.

13. Project Identification. A description of how projects get identified and how they are processed before they reach the contract programmer.

14. Real Estate. A description of the real estate function, its purpose, and how the contract programmer interfaces with it.

15. Importance of and Sample 1391/1391c Documents. Explanation of the importance of the DD Form 1391 programming document and examples of properly completed DD Forms 1391/1391c for the various programming avenues along with an explanation of the sources of the information found on the document.

The author recommends that the handbook be written by someone with at least one year of experience in contract programming. This minimum level of experience is necessary for proper evaluation of the other suggested topic areas not considered for inclusion by the author of this research.

Recommendations for Future Research

This research was intended to be the initial step towards the publication of a handbook for new contract programmers. Recommendations for future research include the following:

1. Survey the Headquarters United States Air Force contract programming personnel.

2. Survey the contract programmers stationed overseas.

3. Research the job of the contract programmer in a wartime environment.

4. Write and publish the handbook.

Appendix A: Survey Population

MAJCOM Level List	Number of Programmers
Headquarters Air Force Logistics Command	5
Headquarters Air Force Systems Command	6
Headquarters Air Training Command	5
Headquarters Military Airlift Command	5
Headquarters Strategic Air Command	7
Headquarters Tactical Air Command	*17
Subtotal (MAJCOM Level)	45

Base Level List	
Altus OK	1
Andrews MD	4
Barksdale LA	3
Beale CA	2
Bergstrom TX	3
Blytheville AR	1
Brooks TX	1
Cannon NM	2

* Includes Requirements and Program Development Personnel.

Base Level List	Number of Programmers
Carswell TX	3
Castle CA	2
Chanute IL	4
Charleston SC	1
Cheyenne Mountain Complex CO	1
Columbus MS	2
Davis Monthan AZ	2
Dover DE	2
Dyess TX	2
Edwards CA	3
Eglin FL	2
Ellsworth SD	1
England LA	2
F.E. Warren WY	1
Fairchild WA	2
Goodfellow TX	1
Grand Forks ND	2
Griffiss NY	1
Grissom IN	3
Hanscom MA	3
Hill UT	6
Holloman NM	4
Homestead FL	6
K.I. Sawyer MI	3
Keesler MS	3

Base Level List	Number of Programmers
Kelly TX	1
Kirtland NM	6
Lake Mead NV	1
Laughlin TX	2
Little Rock AR	4
Loring ME	5
Lowry CO	1
Luke AZ	2
MacDill FL	6
Malmstrom MT	2
March CA	2
Mather CA	1
Maxwell AL	2
McChord WA	4
McClellan CA	2
McConnell KS	2
Minot ND	1
Moody GA	3
Mountain Home ID	1
Myrtle Beach SC	2
Nellis NV	3
Norton CA	2
Offutt NB	4
Patrick FL	3
Pease NH	2

Base Level List	Number of Programmers
Peterson CO	1
Plattsburg NY	2
Pope NC	2
Reese TX	2
Robins GA	4
Scott IL	1
Seymour Johnson NC	2
Shaw SC	2
Sheppard TX	3
Tinker OK	4
Travis CA	2
Tyndall FL	4
USAF Academy CO	5
Vandenberg CA	2
Whiteman MO	2
Williams AZ	2
Wright-Patterson OH	5
Wurtsmith MI	2
Subtotal (Base Level)	190

MAJCOM Level	45
Base Level	190
Total	235

Appendix B: Discussion On Questionnaires

Introduction

This discussion provides a review of the current
literature (1980 to 1985) written about questionnaires.
More specifically, this discussion will define what a
questionnaire is and describe some of the advantages and
disadvantages of using questionnaires. Furthermore, the
design and construction of questionnaires and a significant
problem with the use of questionnaires will be discussed.

Definition

A questionnaire is a survey instrument used to collect
data by presenting a list of questions or statements to
possible respondents. The recipients of the questionnaire
are asked to respond to the questions and statements, and
their responses (data) are then collected and analyzed.

Advantages and Disadvantages of Questionnaires

According to Weiss, "Questionnaires are an excellent
way of obtaining large amounts of information from a large
number of people at a relatively low cost" (14:7). Weiss
(14:7-8) presents both advantages and disadvantages in using
questionnaires over other survey instruments for data
collection.

The first advantage, when comparing the use of
questionnaires to the direct personal interview technique,

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is that "The possibility that the interviewer might directly influence an answer is avoided" (14:7). According to Emory, the interviewer can "distort the results of any survey by inappropriate suggestions, word emphasis, tone of voice, and question rephrasing" (4:167). This possibility is minimized by using a questionnaire.

Another advantage is that "The persons answering the questionnaire have more time to think about and investigate a question before answering it" (14:7). This allows the individuals the opportunity to evaluate their answer before responding.

The third advantage is that "Questionnaires solve the problem of geographical limitations" (14:7). The questionnaire can be mailed out within large geographical areas, allowing the researcher to contact a broad base of respondents. Also, "Responders are often more accessible by mail than they are for a personal interview" (14:7). Questionnaires allow the interviewer to get information from people he may not otherwise be able to reach.

Another advantage is that "The time devoted by the interviewer to the survey is considerably less, especially when many people are interviewed" (14:7). Therefore, "The cost of the questionnaire is low compared to the cost of numerous personal interviews" (14:7).

The final advantage presented by Weiss is that "Questionnaires are faster when a larger number of people are involved because they [the people] can be handled

simultaneously" (14:7).

The advantages described above must be weighed against the disadvantages of questionnaires, some of which are listed below.

The first disadvantage is that "The receivers of questionnaires who feel strongly about the subject are more likely to respond than those who have minor or no interest" (14:8). This fact can result in responses which only present one side of the issue.

Another disadvantage is that "Questionnaires lack persuasiveness in getting responders to complete and answer every question" (14:8). The responder may ignore or overlook questions. This can be a disadvantage if responses to all the questions on the questionnaire are needed to create meaningful results from the survey.

One final disadvantage presented by Weiss is that "You do not get 100 percent return of questionnaires" (14:8). This can be a problem if the sample size was small to begin with. If the return rate of the questionnaires is not adequate, as determined by the researcher, then the results of the survey may lack credibility or may be inappropriate or impossible to analyze.

Design of Questionnaires

The design of the questionnaire has a large impact on the usefulness and value of the information obtained. "The usefulness of the information [collected from the

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questionnaire] depends upon the clarity of the questions and upon thorough investigation" (14:7). Also "questionnaires are only valuable if they ask appropriate questions which people can understand and ask them in a format people can answer" (9:100). Therefore, the design of the questionnaire must address the clarity and appropriateness of the questions as well as the format of the questions.

Maher (9:100-104) breaks the process of questionnaire design into three areas. These areas are as follows:

> First, can a standardized questionnaire be used, or should an original questionnaire be designed? Second, is information needed about a general phenomenon (e.g., organization climate, job satisfaction) or specific, clearly defined issues (e.g., what kind of training will help operators work faster; how do supervisors get training on new product specifications)? Third, to what extent should open-ended and closed-ended questions be used [9:100]?

Standardized questionnaires are normally used when the information needed by the interviewer is general in nature. Conversely, original questionnaires are normally designed and used when the interviewer needs specific information (9:100).

Questions in the questionnaire can be closed-ended, open-ended, or a combination of both. Closed-ended questions result in responses such as "yes" and "no", or "like" and "dislike". These types of responses are easily tabulated and analyzed. Open-ended questions ask the respondent to provide original responses. These types of responses are more complicated to analyze (9:100).

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The choice of what type of question should be used depends on what type of information the interviewer is looking for. Maher (9:102) recommends that a combination of open-ended and closed-ended questions be used in a questionnaire so as to get a clearer response from the respondent (9:102).

Construction of Questionnaires

In constructing the questionnaire, the researcher is forced to determine exactly what information he needs to collect and how he is going to collect it. Maher (9:102-110) discusses eight steps in constructing questionnaires.

The first step in constructing questionnaires is for the researcher to determine what information he needs to know so that he can ask appropriate questions (9:102).

The next step is for the researcher to choose the type of response format he wants to use. The format for the questionnaire, again, can include either open-ended questions, closed-end questions, or a combination of both (9:103-104).

The third step in constructing a questionnaire is to determine the frame of reference of the respondents. During this step, the researcher must determine the suitable vocabulary for the respondent. The researcher must consider the background of the respondent, such as how well informed the respondent is and whether or not the respondent might be

biased about the topic (9:105).

The following step is to write the questions. The questions need to be written so that they are easily understood, easy to answer, and ask for all pertinent information (9:106).

The fifth step is to prepare a summary sheet. A summary sheet is a tool used to determine how the researcher will analyze the data. A summary sheet for a closed-ended question survey would be a sheet with all the questions listed on it and adequate space alongside each question to tally the number and types of responses to the question (9:107).

Pretesting the questionnaire on other people and revising it if necessary is the next step. Pretesting will help the researcher to determine whether or not the questionnaire asks for the necessary information (9:108).

> Pretesting an instrument is necessary because, as Backstrom and Hursch (1963) have pointed out, "No amount of intellectual exercise can substitute for testing an instrument designed to communicate with ordinary people" [8:269].

The seventh step is to construct the total questionnaire. This includes the questions, the sequencing of the questions, directions on how to fill out the questionnaire, and format of the questionnaire (9:108).

The final step is to distribute the questionnaires. In this step the researcher determines the amount of the population to be sampled and submits the questionnaire to them (9:110).

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The Nonresponse Problem

As previously noted in the discussion of disadvantages of questionnaires, there are some problems associated with using questionnaires. A very significant problem is the error induced by nonresponse. "This error occurs when you are not able to find those whom you are supposed to study" (4:165). Nonrespondents include people who either don't answer the questionnaire or answer the questionnaire incorrectly. This type of error can result in slanted or meaningless results.

Yu and Cooper (15:36) present three possible solutions to the problem of nonresponse. These include substituting someone else for the missing respondents, attempting to determine the impact on the survey results due to nonrespondents and improving the research design to reduce the number of nonrespondents.

Yu and Cooper recommend that the researcher improve the research design. They feel it is the preferable solution because "it is an attempt to eliminate nonresponse bias entirely and thus avoid the untestable assumptions present in other solutions" (15:36). Their recommendation is supported by Erdos (5:149). Erdos says "The one rule which is true for all survey methods is that if the job is well planned and well executed, the percentage of nonresponse will be small" (5:149).

Summary

A questionnaire is a survey instrument used to collect data. The use of questionnaires has its advantages and disadvantages. The design of the questionnaire has a large impact on the usefulness and the value of the information obtained. In constructing the questionnaire, the researcher is forced to determine exactly what information he needs to know and how he is going to collect it. Finally, a very significant problem with the use of questionnaires is the error induced by nonresponse.

Appendix C: <u>Approved Survey</u>

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
AIR FORCE INSTITUTE OF TECHNOLOGY
WRIGHT-PATTERSON AIR FORCE BASE OH 45433-6583

REPLY TO
ATTN OF. LS

1 8 APR 1986

SUBJECT U.S.A.F. Contract Programmer Information Survey
(USAF Survey Control Number 86-18)

TO. Survey Participant

1. Often personnel newly assigned to contract programming
are left to "learn by doing" the job of contract programming.
They stumble through by the process of trial and error. They
are told to read regulations and ask questions of other
contract programmers. This process of learning can be very
slow and frustrating for the new contract programmer.

2. The attached survey is a part of a research project being
done to determine what information the current Air Force
contract programmers in the field perceive should be included
in a handbook designed to help new personnel learn the job
of contract programming as quickly as possible. The intent
of this handbook is not to be a "how to" book but a general
information book for new personnel. The information you
provide will be used to develop an outline of what information
should be in the book.

3. Your participation is voluntary. Your individual
responses will be combined with others and will not be
attributed to you personally.

4. Please complete the attached survey and return it to
AFIT/LSG in the enclosed envelope within five working days.
If you have any questions, contact Captain Donald Kellogg
at AUTOVON 785-5435. Thank you for your cooperation and
participation.

LARRY L. SMITH, Colonel, USAF   2 Atch
Dean   1. Questionnaire
School of Systems and Logistics   2. Return Envelope

U.S. AIR FORCE CONTRACT PROGRAMMER
INFORMATION SURVEY

PART I

Please circle the letter to indicate the appropriate answer.

1.   I am currently assigned to

   a.   MAJCOM Level
   b.   Base Level

2.   I have been a contract programmer for

   a.   0-6 months
   b.   6-12 months
   c.   12-18 months
   d.   More than 18 months

3.   I work for the Air Force as a

   a.   Civilian member
   b.   Military member

PART II

This part of the survey relates to your perception as to
whether or not certain topic areas should be included in a
handbook designed to help new personnel learn the job of
contract programming quickly.

Topic areas are listed at the left in alphabetical order,
each with a corresponding set of numbers. The numbers are
a five point increasing scale. The scale is used to rate
the answer to the question:

   Based on your personal experience, which topics do you
   recommend for inclusion in a handbook designed to help
   new personnel learn the job of contract programming as
   quickly as possible?

The numbers on the scale correspond to the following
perceptions:

   (1)   Strongly do not recommend
   (2)   Do not recommend
   (3)   Don't know/No opinion
   (4)   Recommend
   (5)   Strongly recommend

Please indicate your opinion by circling the appropriate
response.

```
SCALE:  (1)  Strongly do not recommend
        (2)  Do not recommend
        (3)  Don't know/No opinion
        (4)  Recommend
        (5)  Strongly recommend
```

                                           (-) --> (+)

1. Air Force Regulations   1 2 3 4 5

    A listing and description of the regulations
    and manuals applicable to contract
    programming.

2. Airfield, Noise, and Explosive Safety Waivers 1 2 3 4 5

    A description of what each of these waivers
    is, their purpose, and why the contract
    programmer must know about them.

3. Approval Authorities   1 2 3 4 5

    A description of what approval authorities
    are, their legal aspects, and how they impact
    the programming process.

4. Base Master Planning   1 2 3 4 5

    A description of what base master planning
    is, its makeup and function, and how the
    contract programmer interfaces with it.

5. Civil Engineering Contract Reporting System   1 2 3 4 5
    (CECORS)

    A description of what CECORS is, its purpose,
    what information it provides, and what the
    contract programmer would use the information
    for.

6. Construction Cost Estimating   1 2 3 4 5

    A description of the various methods of cost
    estimating (i.e., like structure, square foot
    costing, systems costing, unit pricing) and
    the role of the contract programmer in the
    preparation of a cost estimate.

7. Economic Analysis   1 2 3 4 5

    A description of what an economic analysis
    is, its purpose, and the role of the contract
    programmer in the preparation of one.

SCALE: (1) Strongly do not recommend
        (2) Do not recommend
        (3) Don't know/No opinion
        (4) Recommend
        (5) Strongly recommend

                                                    (-) --> (+)

8. Environmental Planning   1 2 3 4 5

    A description of what environmental planning
    is, its purpose, and how the contract
    programmer interfaces with it.

9. Facilities Board   1 2 3 4 5

    A description of what the facilities board
    is, its makeup and function, and the role of
    the contract programmer in preparing for
    one.

10. Planning, Programming, and Budgeting System   1 2 3 4 5

    A description of what the planning,
    programming, and budgeting system at the
    national level is, its makeup and function,
    and how the contract programmer interfaces
    with it.

11. Programming Avenues   1 2 3 4 5

    A description of the various programming
    avenues (i.e., Military Construction
    Program, Operations and Maintenance Program,
    etc.) including the type of work they
    support and their limitations.

12. Project Books   1 2 3 4 5

    A description of what project books are,
    their purpose, and the role of the contract
    programmer in the preparation of them.

13. Project Identification   1 2 3 4 5

    A description of how projects get identified
    and how they are processed before they reach
    the contract programmer.

14. Real Estate   1 2 3 4 5

    A description of the real estate function,
    its purpose, and how the contract programmer
    interfaces with it.

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PART III

Keeping in mind the intent of this handbook is to be general
in nature, do you feel that there are some topic areas
missing from the list. If so, identify them and rate them
appropriately. (Note: An insert will be included in the
handbook which will allow the bases to put the name and
telephone number of the appropriate MAJCOM contacts for
contract programming.)

SCALE:
      (4) Recommend
      (5) Strongly recommend

_____ 4 5

_____

_____ 4 5

_____

_____ 4 5

_____

_____ 4 5

_____

_____ 4 5

_____

_____ 4 5

_____

_____ 4 5

_____

Thank you for your cooperation.

Appendix D: <u>Difference of Sample Means Test</u>

The difference of sample means test (7:171) is used to test the validity of the null hypothesis (Ho: the difference between the sample means of two different populations is not statistically significant). The alternate hypothesis (Ha) in this test is that the difference is significant. Sample means (M) and variances (V) are calculated for each of the two populations (P1 and P2) and then are incorporated into the following equations:

$$a = \frac{V(P1)}{m} + \frac{V(P2)}{n}$$

$$b = (a)exp1/2$$

$$Z = \frac{M(P1) - M(P2)}{b}$$

where

```
    V(P1) = variance of responses in P1
    V(P2) = variance of responses in P2
        m = total number of responses in P1
        n = total number of responses in P2
    M(P1) = arithmetic mean of responses in P1
    M(P2) = arithmetic mean of responses in P2
        Z = test value
```

If the absolute value of the test value (Z) is greater than the critical value, as determined by the significance level chosen, then the difference is deemed significant or, in other words, the null hypothesis is deemed invalid.

An example of this test procedure is as follows:

Ho: Difference of sample means between MAJCOM personnel
   (P1) and base level personnel (P2) for the topic area
   of Air Force Regulations is not significant.

Ha: Difference is significant.

where

$$V(P1) = .4061$$

$$V(P2) = .5552$$

$$m = 41$$

$$n = 152$$

$$M(P1) = 4.488$$

$$M(P2) = 4.533$$

therefore

$$Z = -.39$$

The significance level chosen for this test was .05, as
determined by the researcher's judgment, which has a
critical value of 1.96. Since the absolute value of Z is
less than the critical value, the conclusion is that there
is no significant difference between the means.

Appendix E: Other Suggestions and Comments

The following is a consolidated list of suggestions and comments provided by the survey respondents with regard to specific information to include under the topic areas identified in the questionnaire and the manner in which the handbook should be organized. Corrections have been made for grammatical and spelling errors only.

Be sure item 11 includes Red Horse, IMA Teams and service contracts.

Keep book in a loose leaf binder to allow revisions to be accomplished page by page.

Under Programming Avenues, item 11, recommend inclusion of NAF, private sector financing (PSF), Productivity Investment Funds (PIF) and other fund sources where competition is based on economic payback.

A brief discussion on the importance of keeping channels open with the in-house folks (i.e., don't contract the Air Force craftsmen out of a job).

Stress the importance of keeping the user involved. The programmer is there to serve the user.

Stress internal coordination among programs, engineering, and customer service. We frequently shoot our own foot without any help from the users.

Note on #12. At some bases, contract programmer does PB. At some bases, design engineer does. Some bases, it is a joint effort.

Do not agree with your "general" approach. Yes, be general with regard to related areas such as community planning. But, consider that you could provide specific information on preparing these documents that is not to be found elsewhere or is not conveniently explained or easily understood.

Need to emphasize AFR 86-14 and AFM 86-8. Explain what an aircraft parking plan is and apron, taxiway, and runway criteria also.

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Very few people are just contract programmers and in fact it is not desirable. A handbook for base level DEE people would be most helpful and has been prepared at some bases already. This narrow effort would seem to have little merit.

Suggest use of matrix type of format to delimit requirements, references, etc. as method of summarizing intricacies of programming.

The handbook needs to be designed for a person that has to do programming as an extra duty when the contract programmer is at school or on leave.

A new programmer will have to begin programming right away, so include examples, regs, etc. so he can begin.

A good handbook will become a resource document and will be constantly referred to. A bad handbook will waste space on a shelf. Be careful not to be too general and why limit your aim to the "new" programmer? In 6 months he will be a veteran and will need reference material rather than an introductory handbook. Ever consider a "skeleton" handbook in looseleaf format that could be personalized and added to by each programmer? It might be worth considering.

The handbook would have to be updated periodically to be useful.

SAF/MII decisions dealing with work classifications.

Each base/MAJCOM/Air Staff would need to include work request/project flow.

Include normal flow time for typical MCP and minor construction projects.

Cover major agencies involved in Non-Appropriated Fund allocation (AFWB, local MWR, AAFES, AFCOMS, Open Messes, Private, etc.).

Recap of congressional positions over the past 2-3 years on particular facilities (i.e., child care center).

Private sector funding potential

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Vita

Captain Donald J. Kellogg was born on 27 December 1955 in St. Paul, Minnesota. He graduated from high school in South St. Paul, Minnesota in 1974 and attended Inver Hills Community College from which he received an Associate Degree. He then attended the University of Minnesota Institute of Technology from which he received the degree of Bachelor of Science in Civil Engineering in March 1980. Upon graduation, he attended Officer Training School at Lackland AFB, Texas and was commissioned a second lieutenant in the Air Force. He served as a construction inspector while stationed with the 91st Strategic Missile Wing at Minot AFB, North Dakota and as a contract programmer with the 5099th Civil Engineering Operations Squadron at Elmendorf AFB, Alaska. He then entered the School of Systems and Logistics, Air Force Institute of Technology in June of 1985.

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AD-A174564

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION	1b. RESTRICTIVE MARKINGS
UNCLASSIFIED	

2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT
	Approved for public release; distribution unlimited
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	

4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S)
AFIT/GEM/DEM/86S-15	

6a. NAME OF PERFORMING ORGANIZATION	6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION
School of Systems and Logistics	AFIT/LSM	

6c. ADDRESS (City, State and ZIP Code)	7b. ADDRESS (City, State and ZIP Code)
Air Force Institute of Technology Wright-Patterson AFB, Ohio 45433-6583	

8a. NAME OF FUNDING/SPONSORING ORGANIZATION	8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER

8c. ADDRESS (City, State and ZIP Code)	10. SOURCE OF FUNDING NOS.			
	PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.	WORK UNIT NO.

11. TITLE (Include Security Classification)
See Box 19

12. PERSONAL AUTHOR(S)
Donald J. Kellogg, Captain, USAF

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Yr., Mo., Day)	15. PAGE COUNT
MS Thesis	FROM _____ TO _____	1986 September	90

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB. GR.	Engineering, Civil Engineering, Training, Job Training
13	02		
05	09		

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

Title: INFORMATION REQUIREMENTS FOR THE NEW CONTRACT PROGRAMMER

Thesis Chairman: Anthony P. Negri, Captain, USAF
Assistant Professor of Engineering Management

Approved for public release: IAW AFR 190-1.
LYNN E. WOLAVER 23 Sept 86
and Professional Development
Air Force Institute of Technology (ATC)
Wright-Patterson AFB OH 45433

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT. ☐ DTIC USERS ☐	UNCLASSIFIED

22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE NUMBER (Include Area Code)	22c. OFFICE SYMBOL
Anthony P. Negri, Captain, USAF	513-255-4552	AFIT/DEM

DD FORM 1473, 83 APR   EDITION OF 1 JAN 73 IS OBSOLETE.

The objective of this research was to determine
what information the current Air Force contract programmers
in the field perceive should be included in a handbook
designed to help new personnel learn the job of contract
programming as quickly as possible. A census was conducted
using the mail survey technique. Responses to the survey
were tabulated and analyzed using various statistical
techniques. This research resulted in the identification
of 15 information topic areas which could be incorporated
into a contract programmer's handbook. In addition, the
research pointed out the need for such a handbook as indicated
by the high return rate of the survey.

END

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DTIC